Multi Disease Detection For Leaves Using KNN

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Abstract- *In this paper, we proposed an algorithm for automatic detection of plant leaf diseases. Plant diseases detection and classification is very important task and furthermore automatic detection of plant diseases is an important analysis topic because it could help in observation of giant fields of crops, and therefore mechanically find the symptoms of diseases as shortly as they appear on the plant leaves. The proposed method consists of several steps including thresholding, segmentation, feature extraction and classification. Our proposed method provides quicker and more accurate detection and classification compared to other state-of-art. [4]*

Keywords- Detection, Otsu, Thresholding, SVM, GLCM, K-means, KNN

I. INTRODUCTION

Agriculture plays an important role in economy of a country specially in country like India. Vegetables and fruits are the most important agricultural products. If proper care is not taken in this area then it causes serious effects on plants quality and quantity. Plant diseases are one of the major factor responsible for reduction in plants growth causing losses to farmers and ultimately to economy of country. The early stage diagnosis of plant disease is an important task. Farmers require continuous monitoring of experts which might be prohibitively expensive and time consuming. Therefore, looking for fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic significance. Image processing is used here to provide image based automatic inspection, process control and robot guidance. The objective of this paper is to concentrate on texture of leaves to detect disease and affected area of leaves [7].

Automatic detection uses image processing to detect plant leaf diseases accurately and timely. Image processing is a process to convert an image into digital form and perform some operations to get an enhanced image and extract useful information from it. It is a study of any algorithm that takes an image as input and returns an image as output. Image processing is referred to processing of a 2D picture by a computer [13]. Image processing is used in a wide variety of applications to improve the visual appearance of images and to prepare images for measurement. Image processing usually refers digital Image processing but optical and analog image processing are also possible. Number of diseases are there which causes ecological, economical and society losses. To detect plant pathologies there are many ways. Most of diseases does not have any detectable symptoms associated and are visible very late. Image processing technology in the agricultural research has made significant development [18]. To recognize and classify fungi disease an automated system has been implemented using algorithm such as back propagation, PCA and SVD techniques of neural network. Once a network has been structured for a particular application, that network is geared up to be trained. To start this process the initial weights are randomly chosen. Then, the training, or learning, begins [3]. Supervised and unsupervised are the two training methods to train sets. Supervised training involves a mechanism of providing the network with the desired output. Unsupervised training is where the network has to make intellect of the inputs without outside help or interference [20].

II. LITERATURE REVIEW

Vijai Singh, in this paper[1] proposed a method to improve accuracy of disease detection using SVM classifier along with K-mean clustering algorithm. Banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota are some of those ten species on which proposed algorithm was tested. With very less computational efforts the optimum results were obtained, which show the efficiency of proposed algorithm in recognition and classification of the leaf diseases. Another advantage of using this method was diseases can be identified at early stage or the initial stage.

In this paper[2], author used Image segmentation as the fundamental approach of digital image processing. Among all the segmentation methods, Otsu method is one of the most successful methods for image thresholding because of its simple calculation. Otsu is an automatic threshold selection region based segmentation method. We have proposed an efficient algorithm which consists of three steps. In the initial stage, contrast enhancement algorithm is applied to produce a quality image. Next, we have constructed a bimodal image for

the resultant image. Finally, we have applied the Otsu's binarization on the resultant image.

In this paper[3], author proposed methodology which depends on K-means and Multi SVM techniques which are configured for both leaf & fruit disease detection. K-means clustering and SVM algorithm provides high accuracy and consumes very less time for entire processing. The proposed methodology detects plant diseases accurately and efficiently. For more accuracy, author proposed to extend its database for plant disease detection.

In paper [5], authors introduced technique of Apple fruit disease detection and diseases are: Rot Infections, Apple Scab and Blotch Fungal disease. After image acquisition K-means method is used to detect region of interest and selection of only infected part. Then features are extracted and stored in database also support vector machine is configured for disease classification and recognition.

In paper [6] authors described technique of Pomegranate fruit diseases detection and diseases are: Alterneria, Bacterial Blight and Anthracnose. Pre-processing involved image resizing, filtering and morphological operations. RGB, La*b, HSV and YCbCr are used to create clusters in segmentation. In feature extraction color, morphology and texture features are extracted and gabor filter is used in texture and morphology for obtaining boundary of image. Shape vectors are extracted from healthy fruit image and minimum distance classifier (MDC) is applied for training and classification of diseased or non-diseased images.

Smita Naikwadi, et.al, (2013) proposed in this paper [8] an experiment which shows classification and detection of plant diseases. Insecticides are not always proved efficient because insecticides may be toxic to some kind of birds. It also damages natural animal food chains. The following two steps are added successively after the segmentation phase. In the first step, they identify the mostly green colored pixels. Then using Otsu's method, pixels are masked having green color. Then those mostly green pixels are masked. After that red, green and yellow color based pixel cluster are removed which are infected. The experimental results show that proposed technique is the best for plant detection.

Shruti et.al,(2014) in this paper[9] examined tomato crop which is attacked by the disease which turns the leaf gray, off white and black in the end. Scientifically, this disease is known as cercospora leaf spot or cercospora crucifer arum. This is a disease which often kills young seedlings. Air is the median through which fungus spread on the tomato plant. It is very essential to regularly monitor the plant to check its quality and quantity. In this paper a novel technique has been proposed which visual the growth of plant from stem and check its type of fungus it is infected. The color depth, size of the fungus, location as well as locus of the fungus on leaves give a precise strength of crop quality under the soil.

Rani Pagariya et.al, (2014) provided in this paper [10] a survey related to the plant diseases detection using neural network technique. Nowadays image processing is latest technique to detect plant disease in any crop. The diseases may affect crop growth. This paper mainly concentrates on the various diseases of cotton plants and classifies their disease. There are so many classification techniques such as k-means, k-Nearest Neighbor classifier, Genetic Algorithm, Probabilistic Neural Network, Support Vector Machine, PCA and neural network techniques. After those selection criteria depends upon of the input of the data. This paper gives brief description for the classification of plant diseases.

Prof. Sanjay B. Dhaygude et.al, (2013) in this paper [11] explained plant disease detection and its prevention. Most plant diseases are due to bacteria, viruses and fungus. Fungi are recognized first and foremost from their morphology, with emphasis placed on their reproductive structures. The developed processing scheme consists of four main steps, first a color transformation structure for the contribution RGB image is created, and this RGB is transformed to HSI for color generation and his for color descriptor. Then green pixels are cloaked and removed using specific threshold value, then the image is segmented and the useful segments are extracted, finally the texture statistics is computed from SGDM matrices. Finally, the presence of diseases on the plant leaf is evaluated.

S. Arivazhagan et.al, (2013) showed in this paper [12] symptoms of plant diseases and how to detect them. The proposed technique is used for automatic detection and classification of plant leaf diseases based upon software solution. The proposed scheme has four steps the input RGB image is created, for color transformation structure. Using specific threshold value followed by segmentation process, then the green pixels are masked and removed. After that the texture statistics are computed for the useful segments, finally the extracted features are passed through the classifier. The proposed algorithm has greater accuracy which is 94% with good efficiency.

Haiguang Wang, et.al, (2012), in this paper[14] proposed a technique to recognize the disease of two plants. This investigation has been done on two grapes plants and two wheat plants to improve accuracy using image processing techniques. Back propagation (BP) networks were used as the

classifiers to identify grape diseases and wheat diseases, respectively. The results showed that identification of the diseases could be effectively achieved using BP networks. While the dimensions of the feature data were reduced by using PCA, the optimal recognition result for grape diseases was obtained as the fitting accuracy was 100% and the prediction accuracy was 97.14%, and that for wheat diseases was obtained as the fitting accuracy and the prediction accuracy were both 100%.

III. RESEARCH METHODOLOGY

The step by step proposed approach consists of leaf image database collection, pre-processing of those images using OTSU method, segmentation of those images using k-means clustering method, feature extraction using GLCM method and finally the training and testing of system using KNN method. MATLAB system is being used to perfrom all operations. The plant disease detection technique proposed in this work is based on the following steps:-

a. Pre-processing phase: In the first phase, the plant leaf image is acquired and converted to grayscale using GLCM algorithm. The Grey Level Co-occurrence Matrix(GLCM) algorithm, also known as the gray level spatial dependence matrix, is a statistical method of examining texture that considers the spatial relationship of pixel. We will extract the textural features of the input image.

GLCM algorithm

1. Count all the number of pixels in the matrix in which the data is saved.
2. Store the counted pixels in matrix P[I,j].
3. Check similarity between pixels in the matrix by applying histogram technique.
4. Calculate contrast factor from the matrix:

$$g = \exp\left[\frac{mean(I) - minimum(I)}{maximum(I) - mean(I)}\right]$$

5. The elements of g need to be normalized by dividing the pixels.

$$g = \begin{bmatrix} 0.8 \; if \; g < 0.8 \\ 1.2 \; if \; g > 1.2 \\ g \; otherwise \end{bmatrix}$$

b. Image Segmentation: Image segmentation is the method for conversion of digital image into several segments and rendering of an image into something for easier analysis. Segmentation partitions an image into distinct regions containing each pixels with similar attributes. In this work,we applied threshold based Otsu method on image, after which the region based K-mean segmentation technique is used on acquired image resulting into different clusters. In K-mean grouping is done by minimizing the distances between data and the corresponding cluster centroid.

K -Mean Segmentation

INPUT: Dataset
OUTPUT: Clustered Data
Start ( )

1. Read dataset and dataset has number of rows “r” and number of coloums “m”
2. For (i=0; i=r; i++) /// selection of medoid point
    1. For (j=0; j=m; j++)
    2. Select k=data (i, j);

End

3. Calculation of Euclidian distance()
    1. For (i=0;i=r;i++)
    2. For (j=9;j=m;j++)
    3. A(i)=data(i);
    4. B(i)=data(j);
    5. Distance =squt[(A(i+1)-A(i)^2) –(B(j+1)-B(j)^2);

End

4. Normalization ()
    1. For (k=0;k=data;k++)
    2. Swap k(i+1) and k(i);

end

5. Repeat step 3 to 4 until all points get clustered.

c. Classification of Data: In this work we are using K Nearest Neighbor classifier which is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure (e.g., distance functions). In this phase , KNN classifier will classify segmented image into particular disease depending upon textural features of image

The KNN classifies similar and dissimilar data into more than one classes. K-Nearest neighbor classifiers depend on learning by analogy. The training samples are depicted by n dimensional numeric attributes. Every sample represents a point in an n-dimensional space. Along these lines, the greater part of the training samples is stored in an n-dimensional pattern space. At the point when

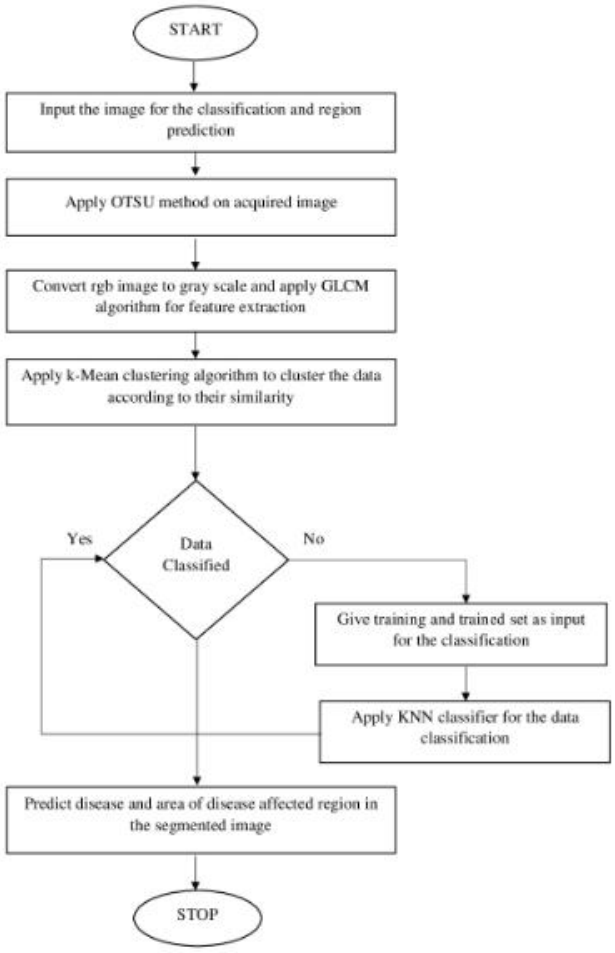

Fig 1: Proposed Flowchart

given an unknown sample, a k-nearest neighbor classifier looks the pattern space for the k training samples that are closest to the unknown sample. "Closeness" is defined in terms of Euclidean distance. Not at all like decision have tree induction and back propagation, nearest neighbor classifiers assigned break even with weight to every attribute. This may bring about confusion when there are numerous irrelevant attributes in the data. Nearest neighbor classifiers can likewise be utilized for prediction, that is, to give back a genuine valued prediction for a given unknown sample. For this situation, the classifier gives back the average value of the genuine valued associated with the k nearest neighbors of the unknown sample. The k-nearest neighbors' algorithm is among the simplest of all machine learning algorithms.

IV. EXPERIMENTAL RESULTS

All the experiments are performed in MATLAB. For input data disease, sample of different plant leaves affected with different diseases is used. Fig 2-6 show the original images which are followed by output segmented images. Segmented image is classified into different plant diseases using KNN method.

The co-occurrence features are calculated on basis of how often pairs of pixel with specific values and in a specified spatial relationship occur in an image.

Fig 2 Leaf is affected with Disease Anthracnose and affected area is 26.42%

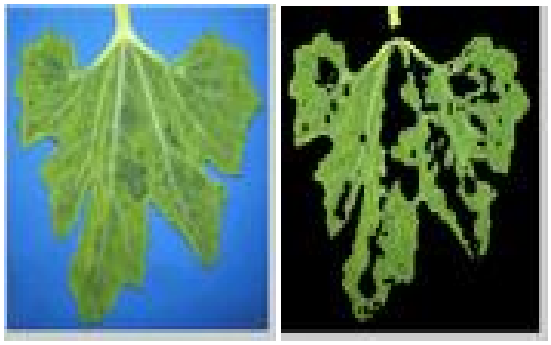

Fig 3 Leaf is affected with disease Leaf Miner and affected area is 36.03%

Fig 4 Leaf is affected with disease Alternia Alternata and affected area is 15.22%

Fig 5 Leaf is affected with disease Alternia Alternata and affected area is 82.9%

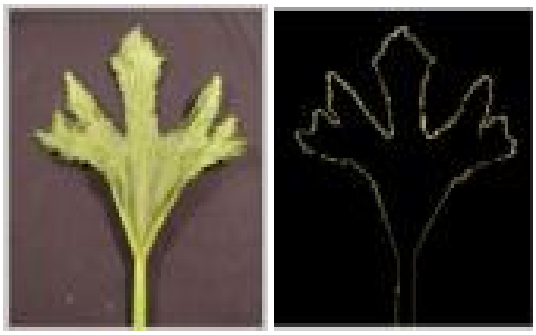

Fig 6 Leaf is affected with disease Alternia Alternata and affected area is 15.33%

The co-occurrence features for the leaves are extracted and compared with the corresponding feature values that are stored in the feature library during training phase. In existing work, SVM technique was used for classification but we found execution time is more in case of SVM technique as in case of large data set it requires higher training time. Moreover SVM technique doesn't perform well in case when data set has more noise. It is able to classify set into only two diseases.In our proposed algorithm we will use KNN classifier in place of SVM. KNN is simplest classification algorithm but it gives higher competitive results.

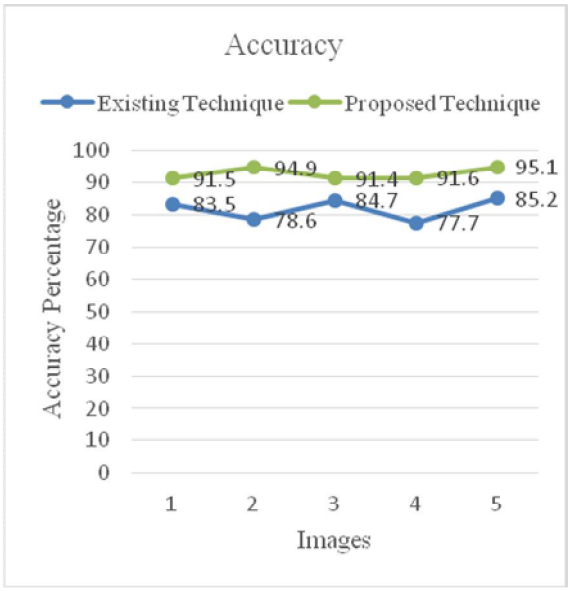

Fig 7: Accuracy Comparison

As shown in figure 7, the accuracy of the proposed technique is enhanced as compared to the existing technique. The accuracy of existing technique lies from 75-85% and that of the proposed technique lies from 90 -96%.

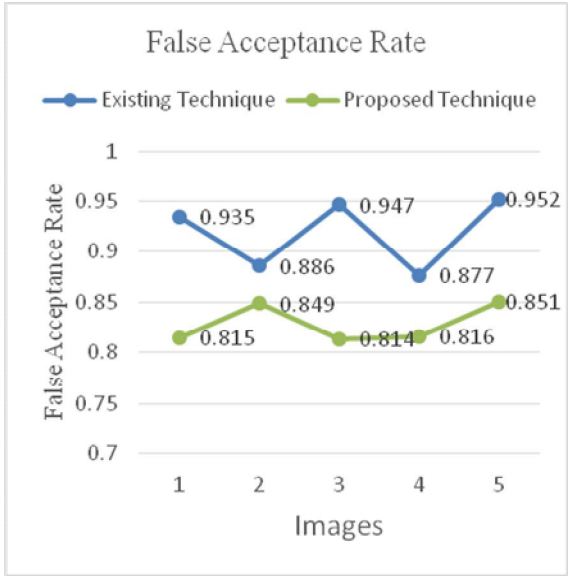

Fig 8: False Acceptance Rate Comparison

As shown in figure 8, the false acceptance rate of the proposed technique is reduced as compared to the existing technique. The false acceptance rate of existing technique lies within the ratio of 0.8-0.9 and that of the proposed technique lies from 0.7-0.8.

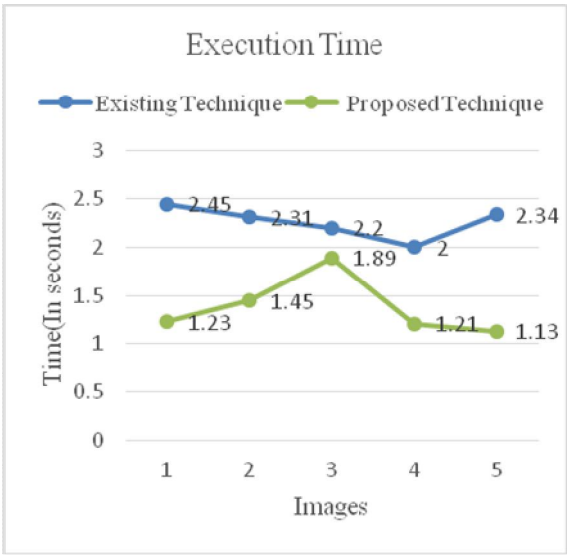

Fig 9: Execution Time

As shown in figure 9, the execution time of the proposed technique is reduced as compared to the existing technique. The execution time of existing technique lies within the ratio of 2-2.5 and that of the proposed technique lies from 1-2.

V. CONCLUSION

In this work, it has been concluded that plant disease detection required three main steps which are feature extraction, segmentation and classification. In the proposed technique GLCM algorithm is used to extract the textural features. The Otsu method is used for spot disease detection. The k-mean clustering is applied to segment input images. The SVM classifier is replaced with the KNN classifier in the proposed work to classify data into multiple classes. The performance of proposed algorithm is tested in terms of accuracy, false acceptance rate and execution time where accuracy is increased up to 10 percent and false acceptance rate and execution time is decreased as compared to existing technique.

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